



Benicia Refinery • Valero Refining Company - California
3400 East Second Street • Benicia, California 94510-1097 • Telephone (707) 745-7011 • Facsimile (707) 745-7339

Certified Mail # 7015 1520 0001 6225 3099

July 28, 2017

United States, et.al. v. Valero, et.al.
Civil Action No. SA-05-CA-0569
May 7-12, 2017 Tail Gas Event
Final Report

Director
Air Enforcement Division (2242A)
Office of Enforcement and Compliance Assurance
U.S. Environmental Protection Agency
1200 Pennsylvania Avenue, N.W.
Washington, D.C. 20460

To Whom It May Concern:

A reportable tail gas event occurred at the Valero Benicia Refinery from May 7, 2017 through May 12, 2017 during the startup of the Sulfur Recovery Unit (SRU) after a sudden loss of power supply from Pacific Gas and Electric (PG&E) caused the entire refinery to shut down on May 5, 2017. This report is submitted pursuant to Paragraph 242 of the Consent Decree between the United States and Valero.

Please contact Kim Ronan at (707) 745-7990 if you have any questions regarding this report.

Sincerely,

A handwritten signature in black ink that reads 'Donald C. Wilson'.

Donald C. Wilson
Vice President & General Manager

DCW/KAR/tac

Enclosure

cc: Director, Air Division (AIR-1), Jordan.Deborah@EPA.gov
Attn: Chief, Air Enforcement Office
U. S. Environmental Protection Agency, Region 9
75 Hawthorne Street
San Francisco, CA 94105
Certified Mail # 7015 1520 0001 6225 3105

Root Cause Failure AnalysisImpact Incident Number: 181596*The information contained below satisfies the requirements of the Valero Consent Decree XII.D.242*Refinery: Benicia
Incident Type: Tail Gas
Combustion Source: IncineratorsDue Date: 7/11/2017
Report Type: Final (Final, Initial or Follow-up)

Previous Dates and Reports: _____

(1.) The date and time that the Incident started and ended:

| | | | | | | | |
|-----------------|-----------------|-----------------|-----------------|------------------|------------------|------------------|------------|
| Times: | <u>1</u> | <u>2</u> | <u>3</u> | <u>4</u> | <u>5</u> | <u>6</u> | <u>7</u> |
| Start/End Date: | <u>5/7/2017</u> | <u>5/8/2017</u> | <u>5/9/2017</u> | <u>5/10/2017</u> | <u>5/11/2017</u> | <u>5/12/2017</u> | |
| From: | <u>7:00 PM</u> | <u>12:00 AM</u> | <u>12:00 AM</u> | <u>12:00 AM</u> | <u>12:00 AM</u> | <u>12:00 AM</u> | |
| To: | <u>11:59 PM</u> | <u>11:59 PM</u> | <u>11:59 PM</u> | <u>11:59 PM</u> | <u>11:59 PM</u> | <u>5:00 AM</u> | |
| Total (Hrs): | <u>5.0</u> | <u>24.0</u> | <u>24.0</u> | <u>24.0</u> | <u>24.0</u> | <u>5.0</u> | <u>0.0</u> |

(2.) Estimate of the quantity of SO₂ that was emitted:Tons of SO₂ = 3.2 tons **SEE ATTACHMENT 1 FOR CALCULATIONS**(3.) The steps taken to limit the duration and/or quantity of SO₂ emissions associated with the Incident:**A. Control House Monitoring****B. Followed startup procedures**

(4.) Detailed analysis that set forth the Root Cause of the Incident, to the extent determinable:

The tail gas event was caused by the sulfur recovery unit startup after a sudden loss of power supply from Pacific Gas and Electric (PG&E) caused the entire refinery to shut down on May 5, 2017.

Pacific Gas and Electric (PG&E) had originally scheduled clearance of electrical lines that feed the Bahia Substation directly upstream of the Valero Benicia Refinery to occur in February 2017 during the refinery's turnaround to minimize potential impacts to the refinery; however, the work had to be rescheduled so PG&E could respond to a PG&E tower that was in danger of falling due to a mudslide along Hwy 24. On March 20, 2017, PG&E notified Valero that the rescheduled work could be completed on May 1, May 5, and May 8, 2017. These clearances did not require Valero to operate any equipment on the Valero-owned power distribution system.

The Bahia Substation is fed by two redundant, independent transmission lines (the Moraga and Vaca-Dixon lines) to ensure both primary and backup electrical power is available to the refinery. The Moraga line was scheduled to be cleared on May 1, 2017. During this scheduled clearance, the refinery would operate on power from the Vaca-Dixon line. That work was completed without incident on May 4, 2017. On May 5, 2017 the Vaca-Dixon line was scheduled to be cleared and the refinery would operate on power from the Moraga line.

After the power outage on May 5, 2017, Valero was informed that sometime prior to the early morning of May 5, 2017, a PG&E islanding/decoupling scheme (a control system) was already falsely alarmed due to a failed coupling capacitor voltage transformer (CCVT) (a metering device that provides the voltage signal). When PG&E opened the Vaca-Dixon transmission line breaker for the scheduled maintenance at approximately 6:40 am on Monday, May 5, 2017, the combination of the failed CCVT with the opening of the transmission line breaker caused the islanding/decoupling scheme to misoperate. The islanding/decoupling scheme then opened all circuit breakers feeding the refinery. The loss of both PG&E lines also forced Valero's Cogen offline, which is designed to occur in the event of a loss of PG&E power because Cogen's 47 MW rating is not sufficient to supply the 65 MW average demand of the refinery. As a result, a refinery-wide power outage occurred.

(5.) Analysis of the measures, if any, that are reasonably available to reduce the likelihood of a recurrence of the Incident including cost and effectiveness of changes in design, operation, and maintenance.

All feasible prevention measures were planned and procedures incorporated for the unit startup.

(6.) Description of corrective action(s) or explanation of why corrective action(s) are not required:

Is corrective action required? No (Yes/No)**The startup followed standard written procedures, which are intended to minimize emissions and ensure the safety of personnel and equipment.**

If corrective action(s) are not complete, what is the proposed schedule?

Start Date: _____

Completion Date: _____

(7.) Stipulated Penalty Analysis: **NOT APPLICABLE**

(8.) The investigation of causes and/or possible corrective actions still are underway 60 days after the end of the incident so an extension is being requested (up to 60 days typically). Input a date only for initial and follow-up reports.

No (Yes/No)

The followup report shall be submitted by: _____

(9.) Is(are) the completion of the implementation of corrective action(s) finalized at this time?

NA (Yes/No/NA)

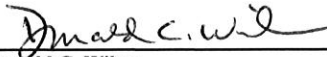
If no, a corrective action completion report is required within 30 days of completion.

Root Cause Failure Analysis

Impact Incident Number: **181596**

Certification (261)

"I certify under penalty of law that I have personally examined and am familiar with the information submitted herein and that I have made a diligent inquiry of those individuals immediately responsible for obtaining the information and that to the best of my knowledge and belief, the information submitted herewith is true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment."

Signed: 
Name: Donald C. Wilson

Date: 7/27/17
Title: Vice President and General Manager

Submit copies to EPA, the applicable EPA regional office (242), and the applicable state agency (376).

Attachment 1 - SO₂ Emission Calculations

(2.) Estimate of the quantity of SO₂ that was emitted:

Std. Temp: 68 deg.

| AG, TG, or HC Flaring | TG Incineration |
|--|---|
| Avg. Flowrate, dscfh (FR) | Incinerator Hourly Flowrate for hour i, dscfh (FR _{inc}) _i |
| Total Duration (TD) 105.9 | Hourly SO ₂ Conc for hour i, ppmvd, 0% O ₂ (Conc SO ₂) _i |
| Avg. Vol. Fr. H ₂ S, scf/scf (ConcH ₂ S) | Hourly O ₂ percent, dry for hour i (%O ₂) _i |
| Tons of SO ₂ = - | 24 hr excess SO ₂ , lb (ER _{TGI}) |
| Tons of SO ₂ = [FR][TD][ConcH ₂ S][8.31 x 10 ⁻⁵] | Total hours of exceedance, hrs (H _{TGI}) |
| Tons of SO ₂ = [[105.9][8.31 x 10 ⁻⁵] | ER _{TGI} = $\sum_{i=1} [FR_{inc,i}][Conc\ SO_2 - 250]_i [(20.9\%O_2)/20.9]_i [0.166 \times 10^{-6}]$ |
| Use this equation for TG flaring during maintenance of a monitored incinerator-adjust ConcH ₂ S to show only the excess over allow H ₂ S conc.-use best eng. judgment. | SEE TABLE FOR CALCULATIONS |
| | Tons of SO ₂ = 3.2 tons |

Input Data for Tail Gas Incident at a Monitored Incinerator

Enter only block hours when CEMS average exceeded 250 ppm for 12-hour rolling average

If more than 24 hourly exceedances, add extra rows to the table as needed

| Hour | Incinerator Exhaust Gas Flow Rate (FR _{inc}) (dscfh) | SO ₂ , ppmvd, O ₂ free | O ₂ Conc. (CEM data) (%) | Excess Emissions from Tail Gas at the SRP Incinerator (lbs SO ₂) |
|------|--|--|-------------------------------------|--|
| 1 | 3,451,840 | 8,774 | 18 | 592 |
| 2 | 3,438,026 | 8,324 | 18 | 557 |
| 3 | 3,445,972 | 5,238 | 18 | 345 |
| 4 | 3,500,715 | 3,712 | 18 | 243 |
| 5 | 3,428,418 | 2,271 | 18 | 139 |
| 6 | 3,385,854 | 1,037 | 18 | 53 |
| 7 | 3,398,576 | 139 | 18 | 0 |
| 8 | 3,518,845 | 58 | 18 | 0 |
| 9 | 3,609,388 | 29 | 18 | 0 |
| 10 | 3,595,542 | 14 | 18 | 0 |
| 11 | 3,651,028 | 9 | 18 | 0 |
| 12 | 3,640,725 | 9 | 18 | 0 |
| 13 | 3,536,779 | 7 | 18 | 0 |
| 14 | 3,496,283 | 6 | 18 | 0 |
| 15 | 3,649,909 | 5 | 18 | 0 |
| 16 | 2,929,932 | 642 | 18 | 23 |
| 17 | 3,483,318 | 1,279 | 18 | 72 |
| 18 | 3,676,843 | 868 | 18 | 46 |
| 19 | 3,652,552 | 613 | 18 | 27 |
| 20 | 3,622,864 | 572 | 18 | 24 |
| 21 | 3,602,383 | 828 | 18 | 42 |
| 22 | 3,596,214 | 1,116 | 18 | 63 |
| 23 | 3,586,143 | 1,645 | 18 | 101 |
| 24 | 3,572,848 | 2,362 | 18 | 152 |
| 25 | 3,570,068 | 2,620 | 18 | 171 |
| 26 | 3,569,831 | 3,003 | 18 | 198 |
| 27 | 3,573,611 | 2,947 | 18 | 194 |
| 28 | 3,578,021 | 2,386 | 18 | 154 |
| 29 | 3,577,074 | 2,579 | 18 | 168 |
| 30 | 3,558,131 | 3,196 | 19 | 198 |

Root Cause Failure Analysis

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| | | | | |
|----|-----------|-------|----|-----|
| 31 | 3,816,053 | 2,423 | 18 | 166 |
| 32 | 3,688,853 | 1,765 | 18 | 112 |
| 33 | 3,723,165 | 1,581 | 18 | 99 |
| 34 | 3,711,680 | 1,472 | 18 | 91 |
| 35 | 3,748,555 | 1,363 | 18 | 83 |
| 36 | 3,846,962 | 1,263 | 18 | 78 |
| 37 | 3,789,233 | 1,321 | 18 | 81 |
| 38 | 3,720,290 | 1,359 | 18 | 83 |
| 39 | 3,782,498 | 1,332 | 18 | 82 |
| 40 | 2,995,355 | 2,423 | 18 | 130 |
| 41 | 3,714,787 | 1,273 | 18 | 76 |
| 42 | 3,657,537 | 1,261 | 18 | 74 |
| 43 | 3,642,124 | 1,247 | 18 | 72 |
| 44 | 3,429,690 | 1,149 | 18 | 61 |
| 45 | 3,357,800 | 1,070 | 18 | 68 |
| 46 | 3,456,822 | 84 | 19 | 0 |
| 47 | 3,480,791 | 0 | 19 | 0 |
| 48 | 2,994,105 | 943 | 16 | 80 |
| 49 | 3,206,777 | 0 | 21 | 1 |
| 50 | 3,177,181 | 0 | 21 | 1 |
| 51 | 2,950,916 | 0 | 21 | 1 |
| 52 | 3,150,821 | 0 | 21 | 1 |
| 53 | 3,360,768 | 0 | 21 | 1 |
| 54 | 3,392,829 | 0 | 21 | 1 |
| 55 | 3,388,590 | 0 | 21 | 2 |
| 56 | 3,884,934 | 737 | 18 | 39 |
| 57 | 3,812,000 | 647 | 18 | 31 |
| 58 | 3,744,619 | 620 | 18 | 29 |
| 59 | 3,838,581 | 607 | 18 | 29 |
| 60 | 3,787,826 | 586 | 18 | 27 |
| 61 | 3,986,362 | 589 | 18 | 28 |
| 62 | 3,720,737 | 709 | 18 | 36 |
| 63 | 3,916,593 | 639 | 18 | 32 |
| 64 | 3,933,699 | 602 | 18 | 29 |
| 65 | 3,831,460 | 586 | 18 | 27 |
| 66 | 3,916,282 | 582 | 18 | 28 |
| 67 | 3,777,538 | 580 | 18 | 27 |
| 68 | 3,802,205 | 576 | 18 | 26 |
| 69 | 3,867,935 | 560 | 18 | 25 |
| 70 | 3,806,998 | 537 | 18 | 23 |
| 71 | 3,752,118 | 526 | 18 | 22 |
| 72 | 3,770,184 | 1,463 | 15 | 232 |
| 73 | 3,863,868 | 536 | 18 | 23 |
| 74 | 3,728,728 | 537 | 18 | 23 |
| 75 | 3,967,330 | 543 | 18 | 25 |
| 76 | 3,846,343 | 520 | 18 | 24 |
| 77 | 3,802,147 | 512 | 18 | 23 |
| 78 | 3,796,740 | 515 | 18 | 23 |
| 79 | 3,788,124 | 518 | 18 | 22 |
| 80 | 3,776,802 | 515 | 18 | 22 |
| 81 | 3,851,635 | 465 | 18 | 19 |
| 82 | 3,788,262 | 437 | 18 | 17 |
| 83 | 3,771,755 | 428 | 18 | 15 |
| 84 | 3,717,583 | 431 | 18 | 15 |
| 85 | 3,739,612 | 409 | 18 | 13 |
| 86 | 3,818,553 | 394 | 18 | 12 |
| 87 | 3,805,965 | 388 | 18 | 12 |
| 88 | 3,856,939 | 388 | 18 | 12 |
| 89 | 3,849,277 | 387 | 18 | 12 |
| 90 | 3,823,499 | 379 | 18 | 11 |
| 91 | 3,789,811 | 377 | 18 | 11 |
| 92 | 3,896,769 | 377 | 18 | 11 |
| 93 | 3,818,466 | 380 | 18 | 11 |
| 94 | 3,879,610 | 386 | 18 | 12 |

Root Cause Failure AnalysisImpact Incident Number: **181596**

| | | | | |
|-----|-----------|-------|----|-----|
| 95 | 3,887,456 | 377 | 18 | 11 |
| 96 | 3,797,684 | 1,352 | 14 | 220 |
| 97 | 4,002,666 | 377 | 18 | 11 |
| 98 | 4,028,065 | 379 | 18 | 11 |
| 99 | 3,772,866 | 587 | 18 | 28 |
| 100 | 3,954,090 | 610 | 18 | 28 |
| 101 | 3,767,583 | 346 | 18 | 7 |
| 102 | 3,655,286 | 185 | 18 | 0 |
| 103 | 3,519,422 | 95 | 18 | 0 |
| 104 | 3,725,195 | 71 | 18 | 0 |
| 105 | 3,780,743 | 27 | 18 | 0 |
| 106 | 3,854,355 | 12 | 18 | 0 |

Total: **6,378**

For SRPs not subject to NSPS, any exceedance of an SO2 permit limit is a TG Incident (220(17)).

Include explanation of basis for any estimates of missing data points (257):

Not Applicable.

Root Cause Failure AnalysisImpact Incident Number: **181596****Attachment 2 - Stipulated Penalty Analysis**Steps for Completing Stipulated Penalty Analysis

1. Evaluate criteria for stipulated penalties in sequential order from the top beginning with paragraph 250.a. At least one box in paragraphs 250, 251, or 252 must be marked "Yes". Boxes below the box marked "Yes", become "NA".
2. Provide a brief description where applicable.
3. Claim defenses in 253a., 253c., and 254 as applicable.

Section XII: Paragraph 242.(7.) Statement for AG Flaring and Tail Gas Incidents

| <u>Section XII.F. Stipulated Penalty Criteria</u> | <u>Applies?</u> <u>(Yes/No)</u> | <u>Description/Basis</u> |
|--|--|---|
| <u>Paragraph 250 Criteria</u> | | |
| 250.a. | No | |
| 250.b. | No | |
| 250.c. | No | |
| <u>Paragraph 251 Criteria</u> | | |
| 251.a. | No | Feed was returned to the Flexsorb stack when conditions for safe operation allowed. |
| 251.b. | No | |
| <u>Paragraph 252 Criteria</u> | | |
| 252.a. | No | This event was not the result of a malfunction. The unit was in startup mode. |
| 252.b. | No | |
| 252.c. | No | |
| <u>Affirmative Defenses Claimed</u> | | |
| 253.a. | No | |
| 253.b. | Yes | |
| 253.c. (251 does not apply) | Yes | |
| 253.c. (malfunction) | No | |
| 253.d. | No | |
| 254 | No | |